Shiloh Conservation Area (SCA) – City of Billings:

Presented by:

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Land Design Inc.
Landscape Architecture • Land Planning
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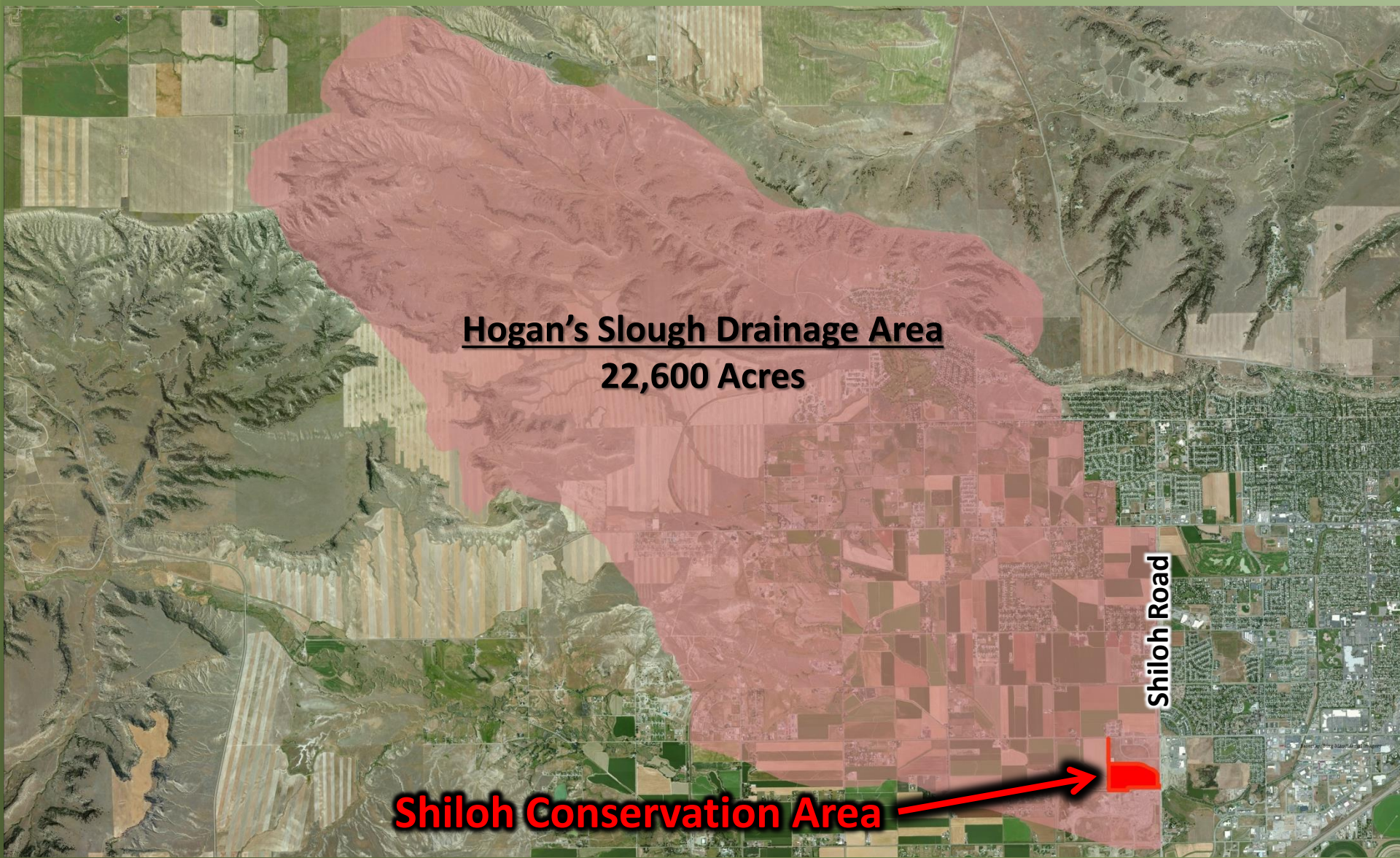
Today's Presentation

- Project background and Objectives
- Data Collection
- Flood Control Design
- Orientation and Site Layout
- Water Control Structures
- Wetland Design
- Community Education and Recreation
- Construction
- Questions

Shiloh Conservation Area
City of Billings

Project Background

- Large Drainage Basin of West Billings

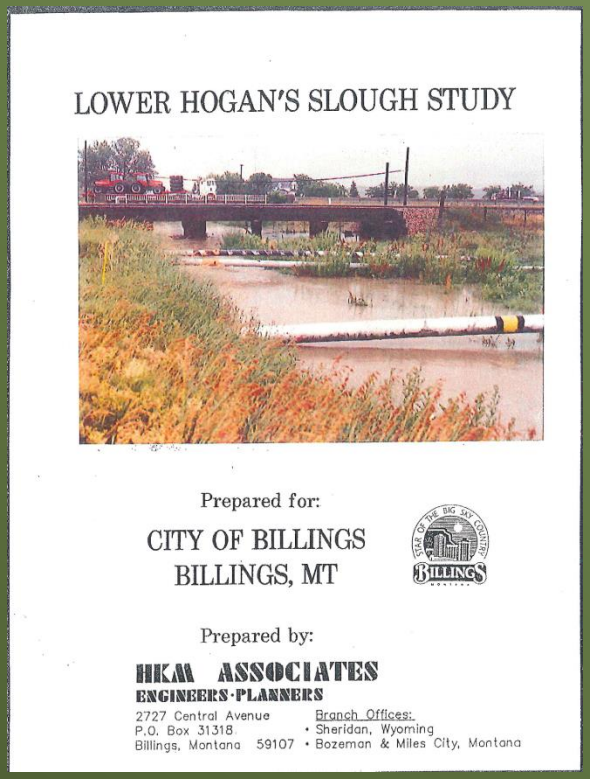


Project Background

- Limited downstream capacity in Hogan's Slough
- Increasing development of West Billings and Future MS4 Requirements
- Proximity to Heritage Trail Network

Project Background

- Previous Studies
  - 1970 US Army COE Flood Mitigation Study
  - 1991 West Billings Stormwater Master Plan Study
  - 1996 HKM Lower Hogan's Slough Study
  - 2007 West Billings Flood Hazard Study
  - 2011 West Billings Flood Mitigation Study


LOWER HOGAN'S SLOUGH STUDY

Prepared for:

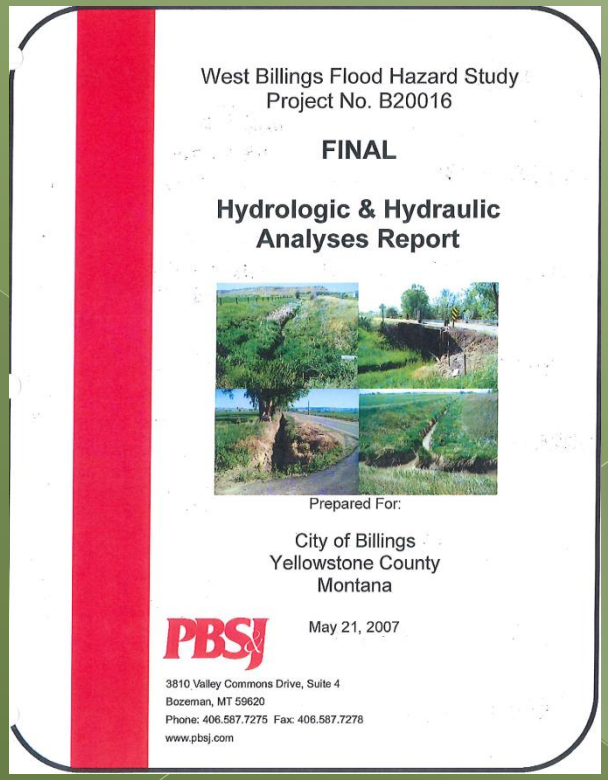
CITY OF BILLINGS
BILLINGS, MT

Prepared by:

HKM ASSOCIATES
ENGINEERS·PLANNERS

2727 Central Avenue
P.O. Box 31318
Billings, Montana 59107

Branch Offices:
• Sheridan, Wyoming
• Bozeman & Miles City, Montana


West Billings Flood Hazard Study
Project No. B20016

FINAL

Hydrologic & Hydraulic Analyses Report

Prepared For:

City of Billings
Yellowstone County
Montana

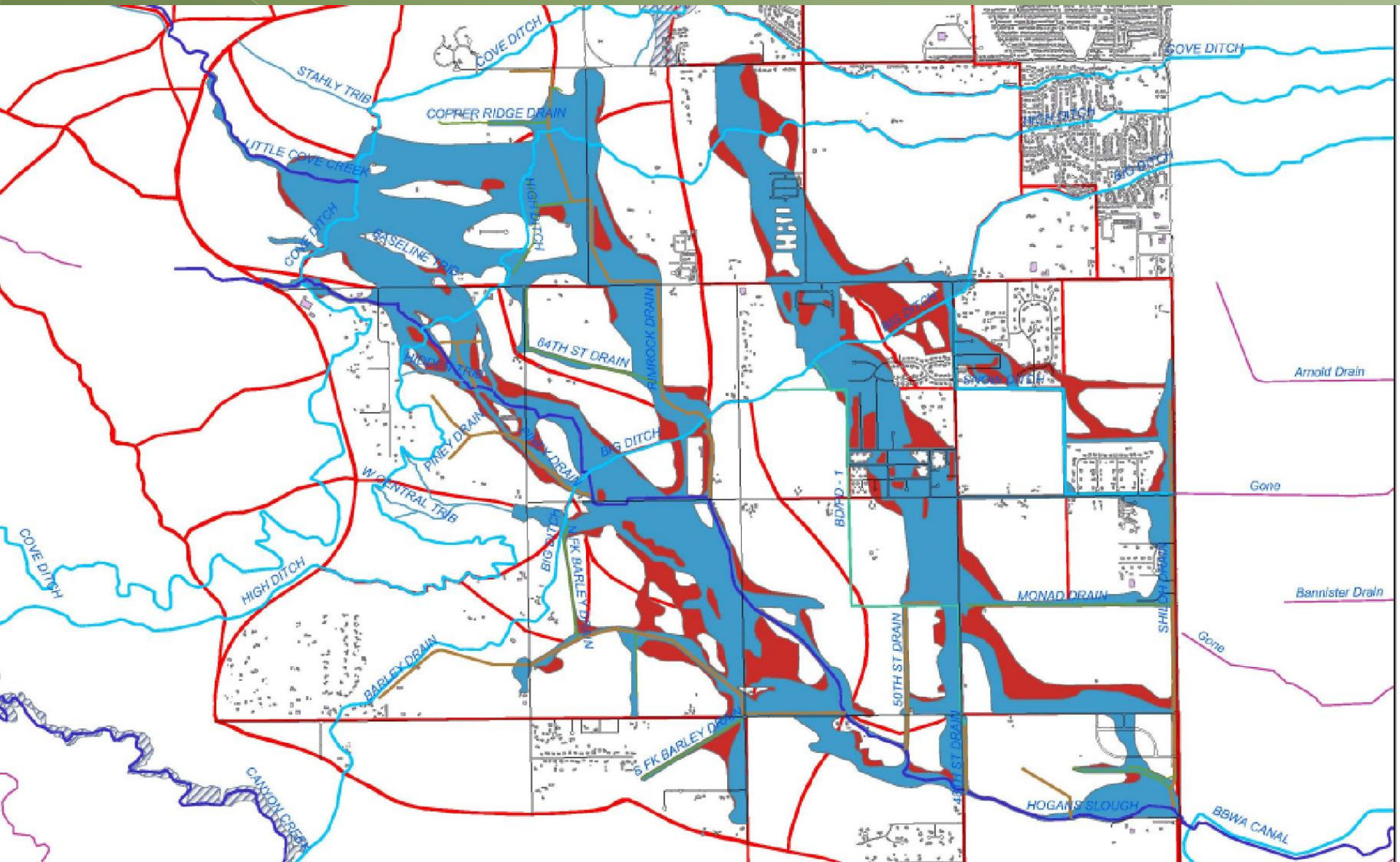
May 21, 2007

PBS&J

3810 Valley Commons Drive, Suite 4
Bozeman, MT 59620
Phone: 406.587.7275 Fax: 406.587.7278
www.pbsj.com

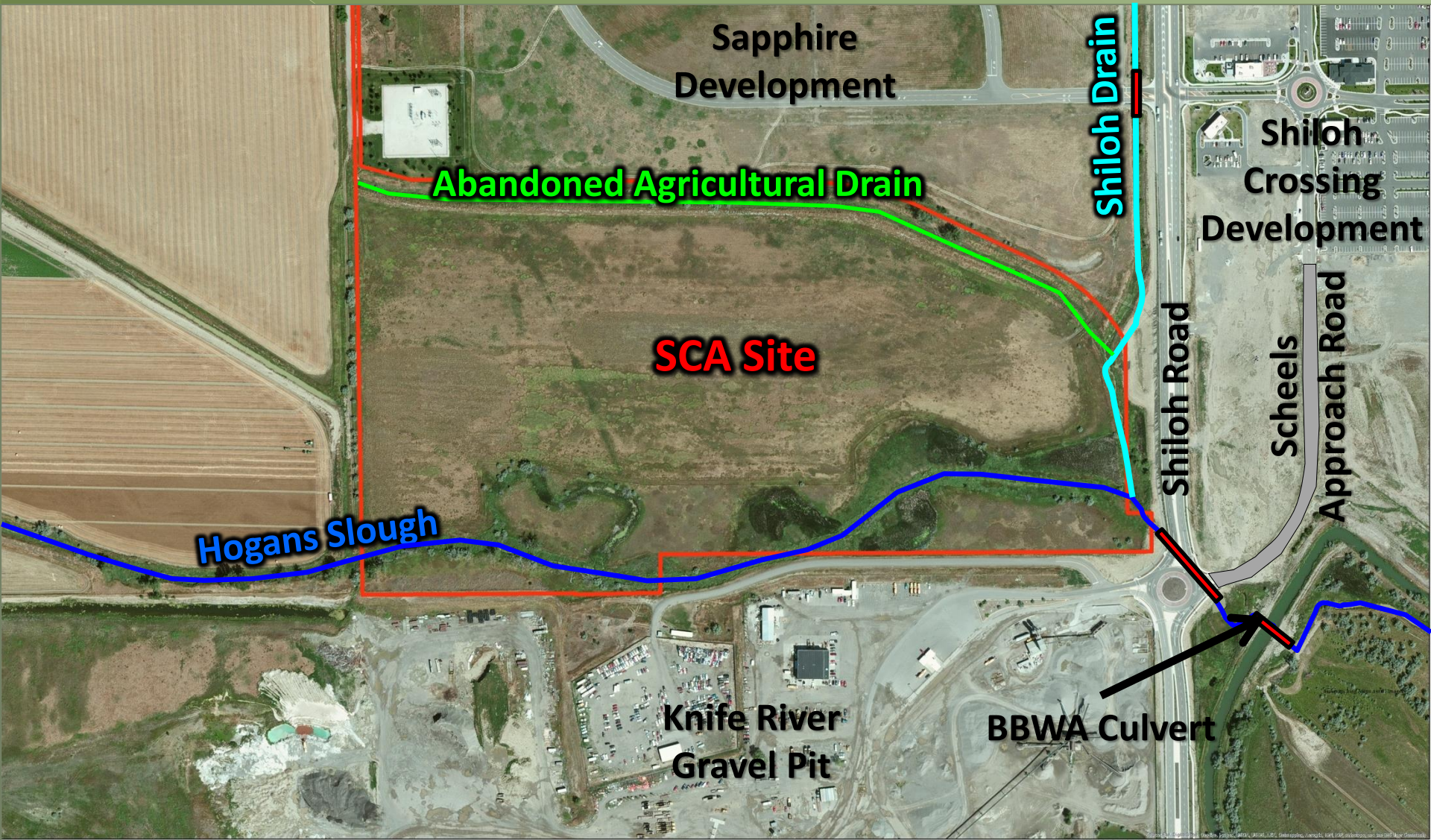
Project Background

- 2007 100 & 500-year Floodplain Boundaries



Project Background

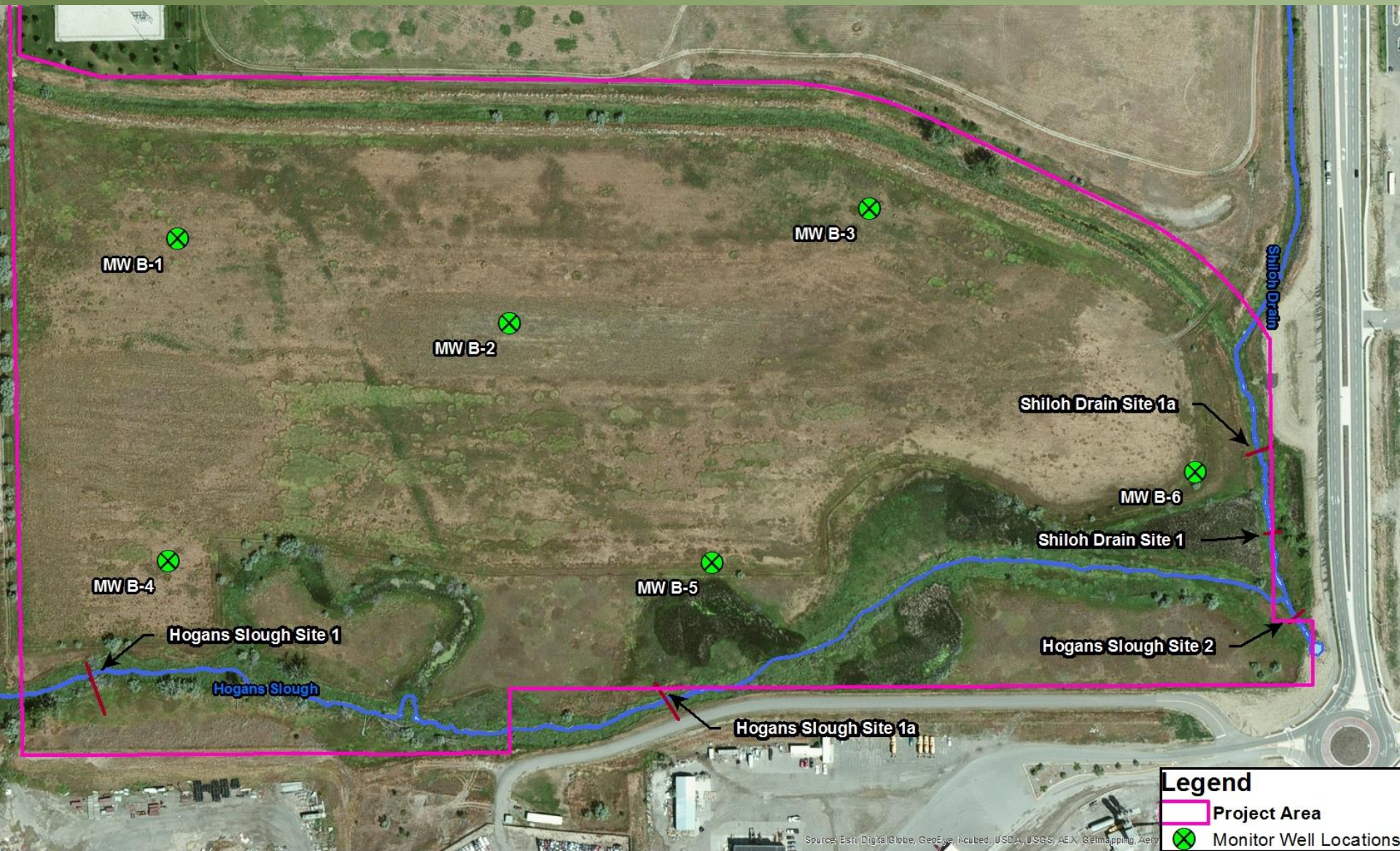
- Pre-project Conditions



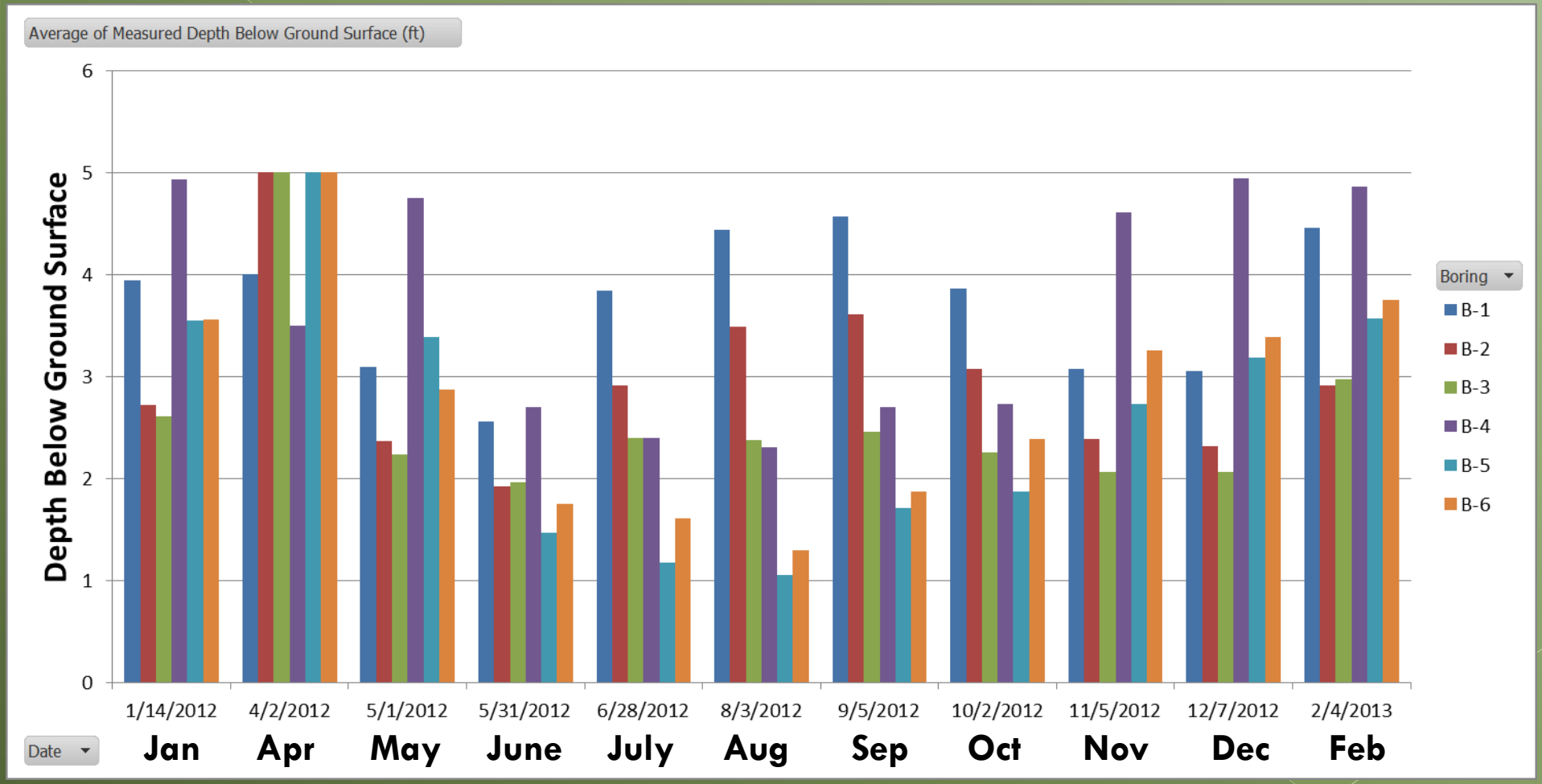
Data Collection

- Geotechnical Investigation
- Groundwater Monitoring
- Baseline Water Quality Sampling
- Flow Measurements
- LiDAR and Ground Surveys

Data Collection
Groundwater and Surface Water Monitoring

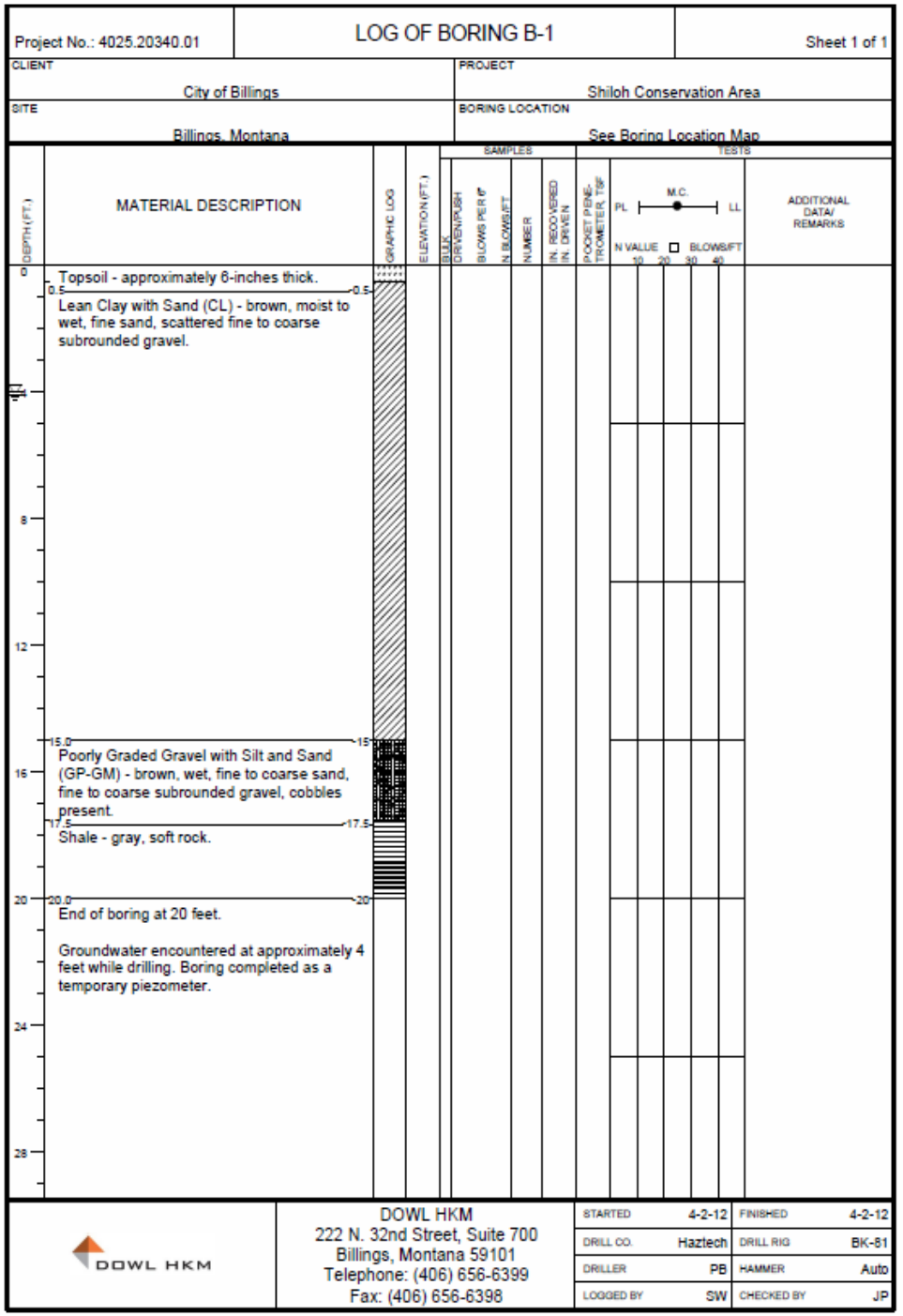


Groundwater Levels



Substrate

- Gravel Pits use to surround this site
- No gravels, mostly lean clays and sands



Project No.: 4025.20340.01 | LOG OF BORING B-1 | Sheet 1 of 1

CLIENT: City of Billings | PROJECT: Shiloh Conservation Area

SITE: Billings, Montana | BORING LOCATION: See Boring Location Map

DEPTH (FT.)	MATERIAL DESCRIPTION	GRAPHIC LOG	ELEVATION (FT.)
0	Topsoil - approximately 6-inches thick.		
0.5	Lean Clay with Sand (CL) - brown, moist to wet, fine sand, scattered fine to coarse subrounded gravel.		0.5
15.0	Poorly Graded Gravel with Silt and Sand (GP-GM) - brown, wet, fine to coarse sand, fine to coarse subrounded gravel, cobbles present.		15
17.5	Shale - gray, soft rock.		17.5
20.0	End of boring at 20 feet.		20
	Groundwater encountered at approximately 4 feet while drilling. Boring completed as a temporary piezometer.		

SAMPLES: BULK | DRIVEN/PUSH | BLOWS PER 6" | N BLOWS/FT | NUMBER | RECOVERED IN. DRIVEN

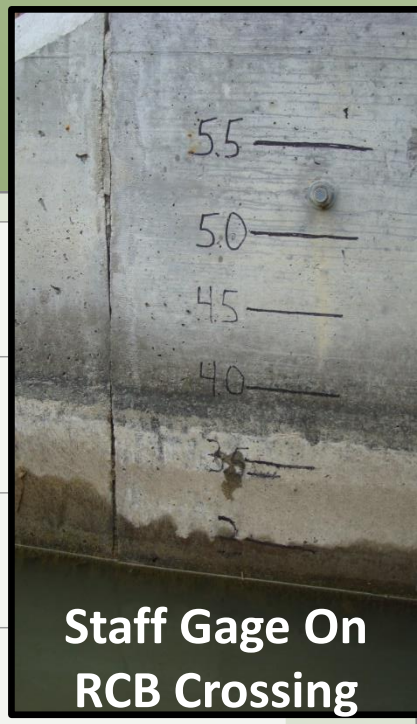
TESTS: POCKET PENETROMETER, TSF | M.C. PL LL | N VALUE | BLOWS/FT (10, 20, 30, 40) | ADDITIONAL DATA/ REMARKS

DOWL HKM

DOWL HKM
222 N. 32nd Street, Suite 700
Billings, Montana 59101
Telephone: (406) 656-6399
Fax: (406) 656-6398

STARTED	4-2-12	FINISHED	4-2-12
DRILL CO.	Haztech	DRILL RIG	BK-81
DRILLER	PB	HAMMER	Auto
LOGGED BY	SW	CHECKED BY	JP

Surface Water Flows Over Time

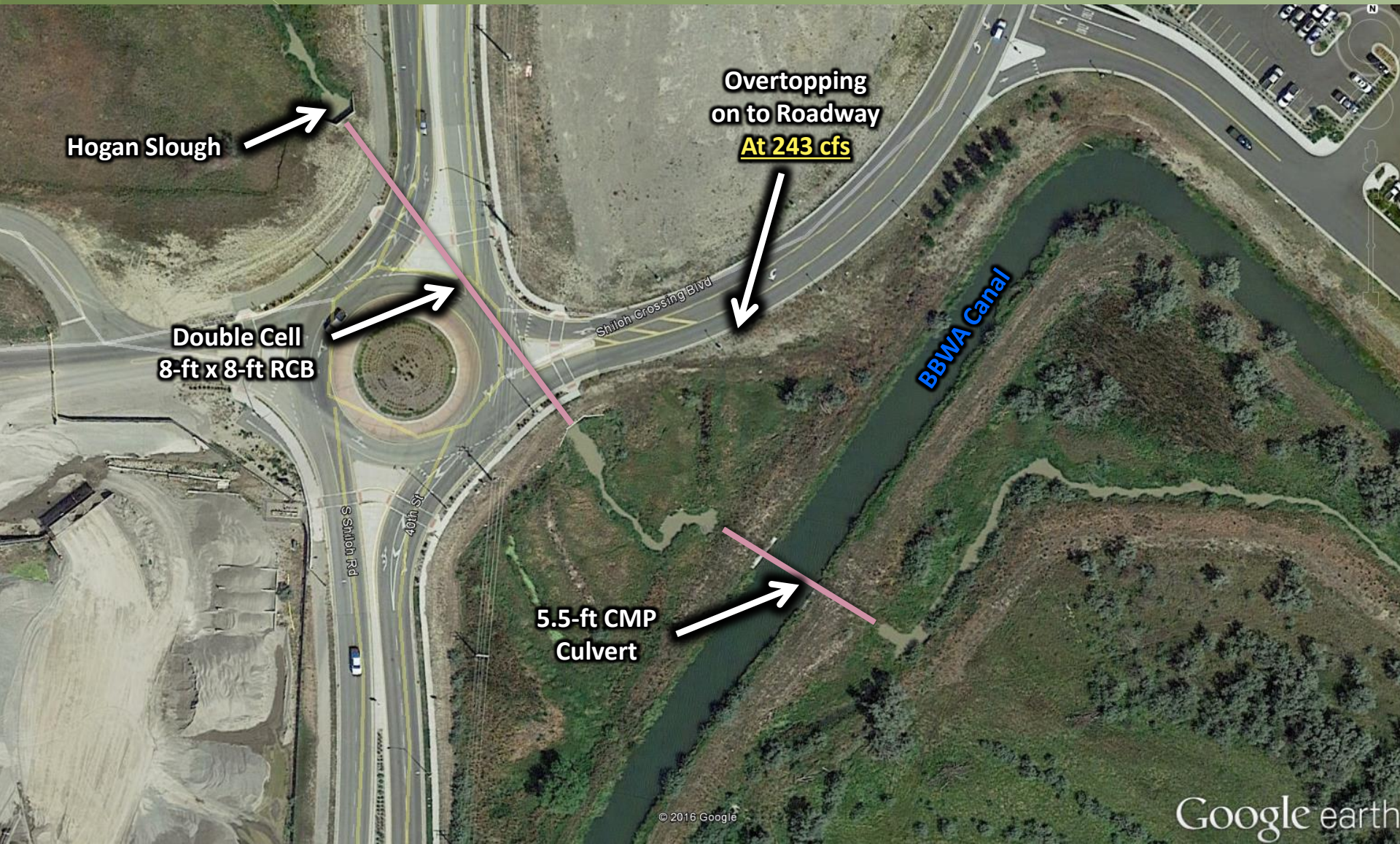


Water Quality Sampling Results

Site	pH (s.u)	TSS (mg/L)	COD (mg/L)	Total N (mg/L)	Total P (mg/L)	Total Cu (mg/L)	Total PB (mg/L)	Total Zn (mg/L)	Oil & Grease (mg/L)
Hogans	8.2/7.8	11/132	21/12	4.9/3.2	0.029/.37	0.012/ 0.005	ND/0.003	0.01/ 0.02	ND/ND
Shiloh	8.0/7.9	ND/576	10/22	12.0/3.0	0.02/0.92	ND/ 0.017	ND/0.012	ND/ 0.07	ND/4
Outlet	8.1/7.8	ND/426	17/12	7.6/3.2	0.026/ 0.82	0.008/ 0.014	ND/0.009	ND/ 0.06	ND/ND

- Each of these are **within the typical range** of inputs from stormwater where wetlands, vegetated swales, and other Low Impact Development (LID) strategies are used to address water quality.

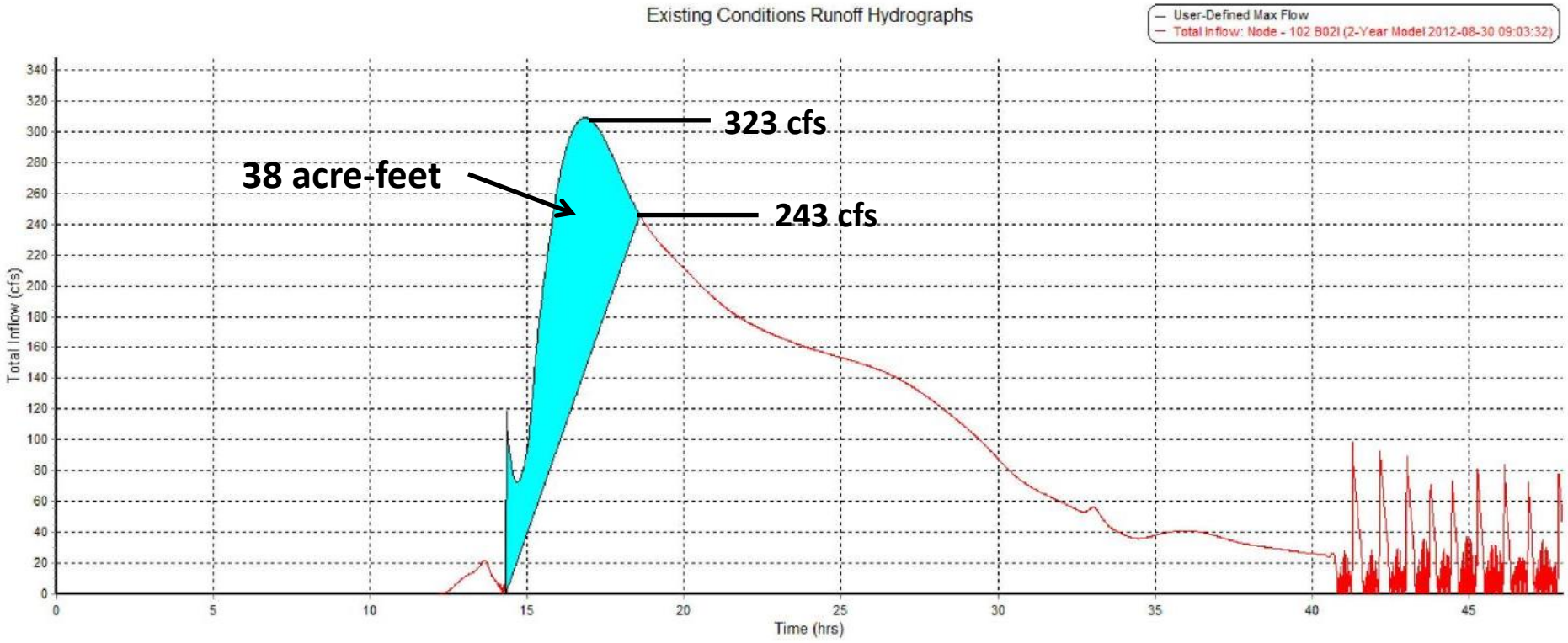
Flood Control Design



Flood Control Design

- Design Flood
  - 2007 West Billings Flood Hazard Study stands as the most current evaluation of West-end hydrology
    - 323 cfs at the 2-year
    - 690 cfs at the 100-year
  - Typical Weather Patterns
    - High Intensity Short-Duration Storms
  - Billings experienced 100-year storm events in 2010 and 2011
    - Highwater marks indicated a maximum flow on the order of 100 cfs
    - 323 cfs is more severe than the 2-year
  - **SCA detention storage is sized to reduce the 2-year design flood**
    - Likely considerably greater protection than the 2-year flood
    - This is just one component of the ultimate Hogan's Slough Flood Mitigation Plan

Required Flood Storage



- Site Layout provides for 49.6 acre-feet of storage

Site Layout


Shiloh Drain
Sediment Pond
Pond 1 Channel
Pond 2
Upper
Wetland Cells
Pond 3
Lower
Wetland Cells
Hogans Slough
Sediment Pond

Water Control Structures

- 18 Water Control Structures

Base & Flood Flow Operation

Flood Flow Operations

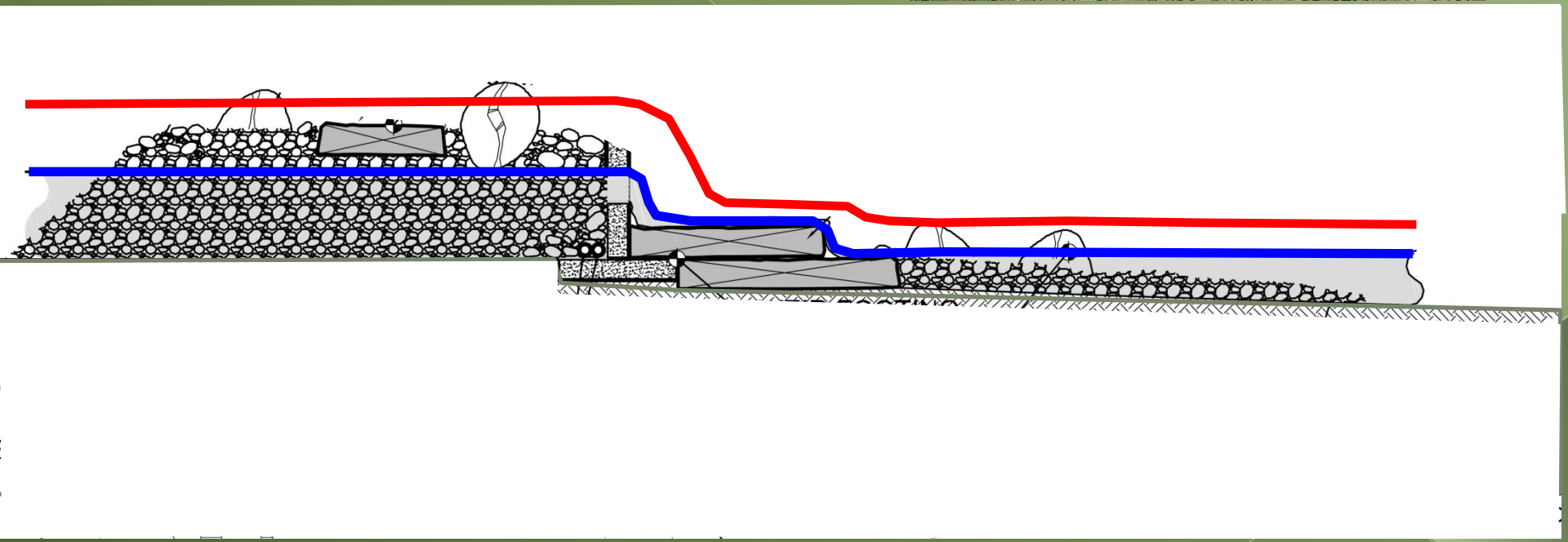
Pond 1 Outfall Structure

- Primary Flood Control Structure for Hogan's Slough
  - Designed to handle base flows and flood flows

Pond 1 Outfall Structure

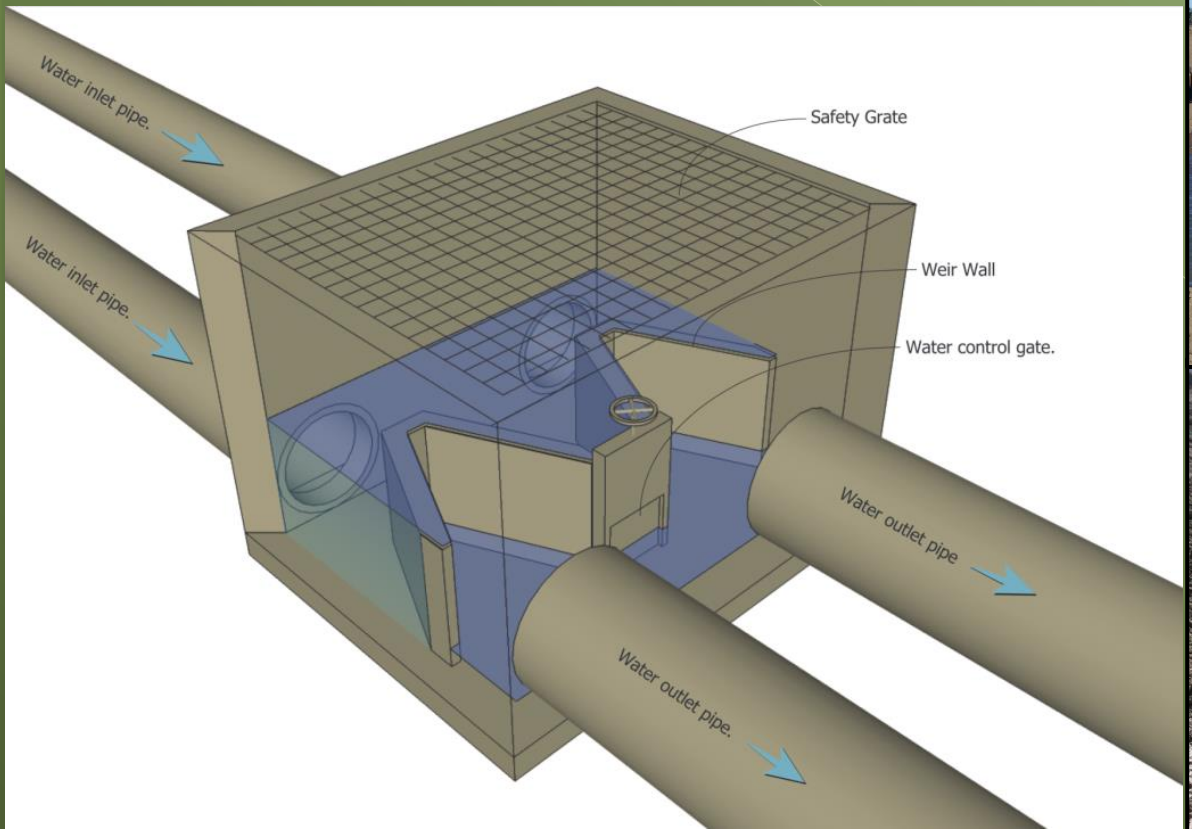
Base Flow Operations

Flood Flow Operations



Pond 2 Outfall Structure

- Flood Control Structure for both Hogan's Slough & Shiloh Drain



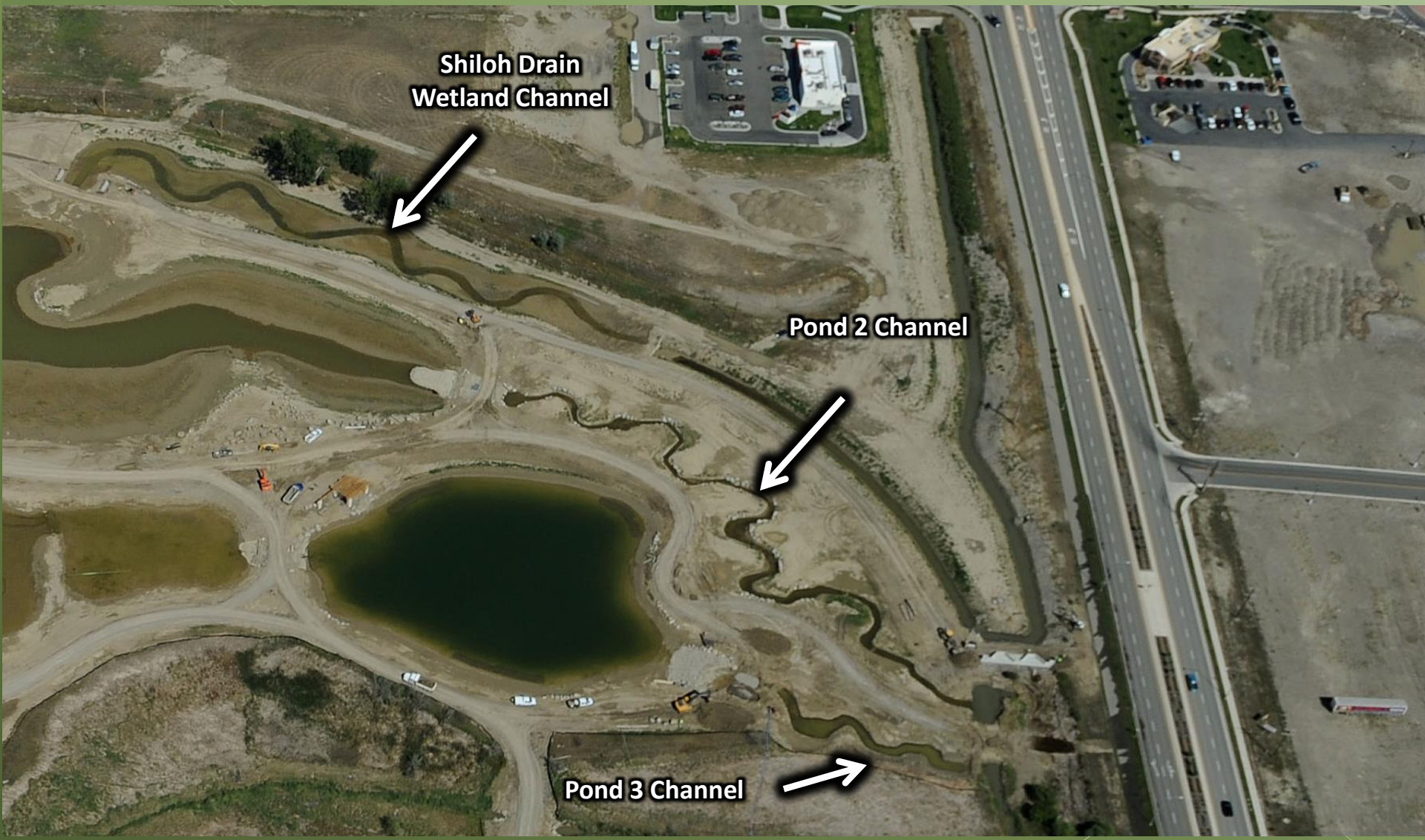
Other Water Control Structures

Wetland Cell 10 Rock Weir

Pond 3 Rock Weir

Shiloh Drain Diversion Structure

Conveyance Channel



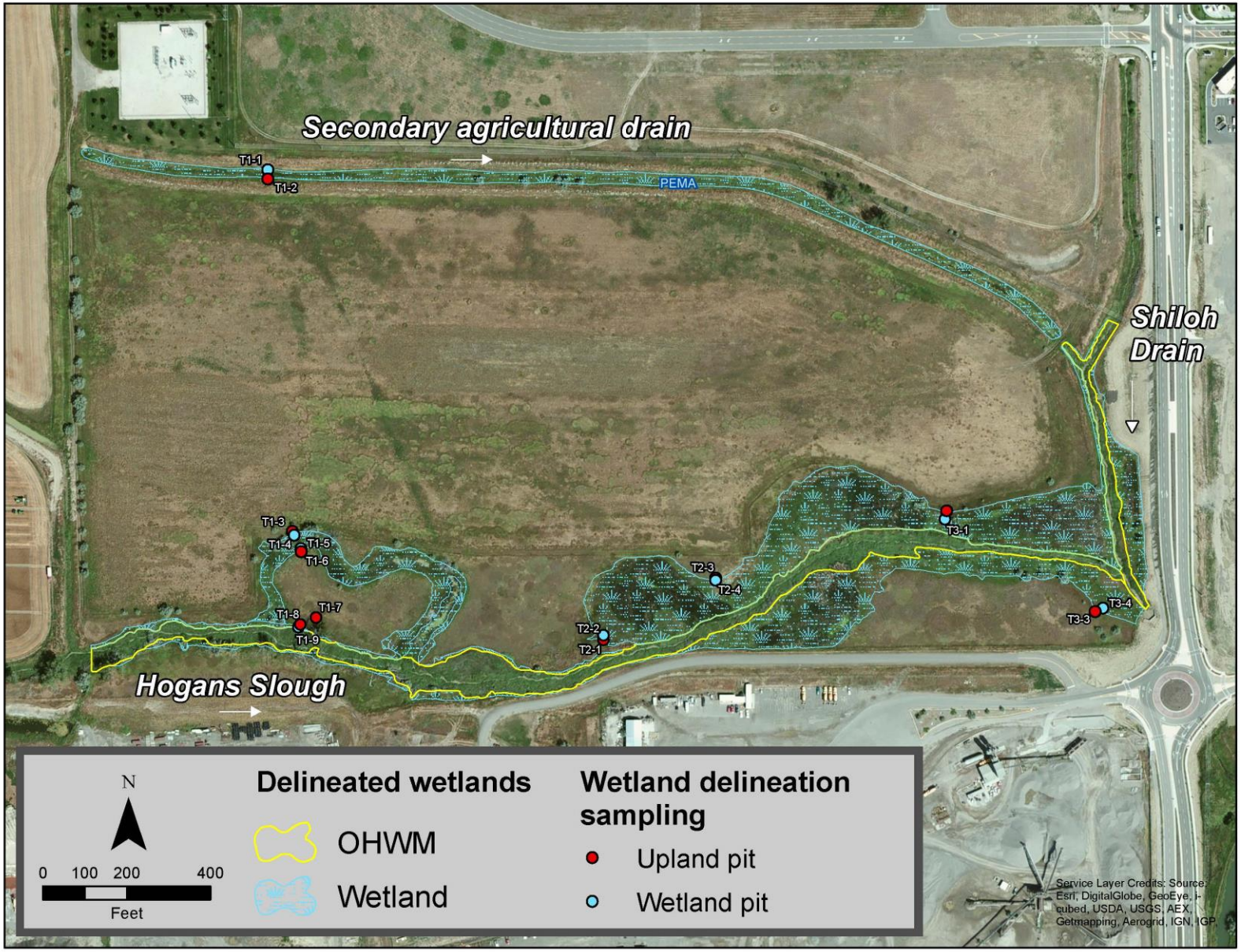
Pond 2 Channel under High flow

Shiloh Drain Wetland Channel

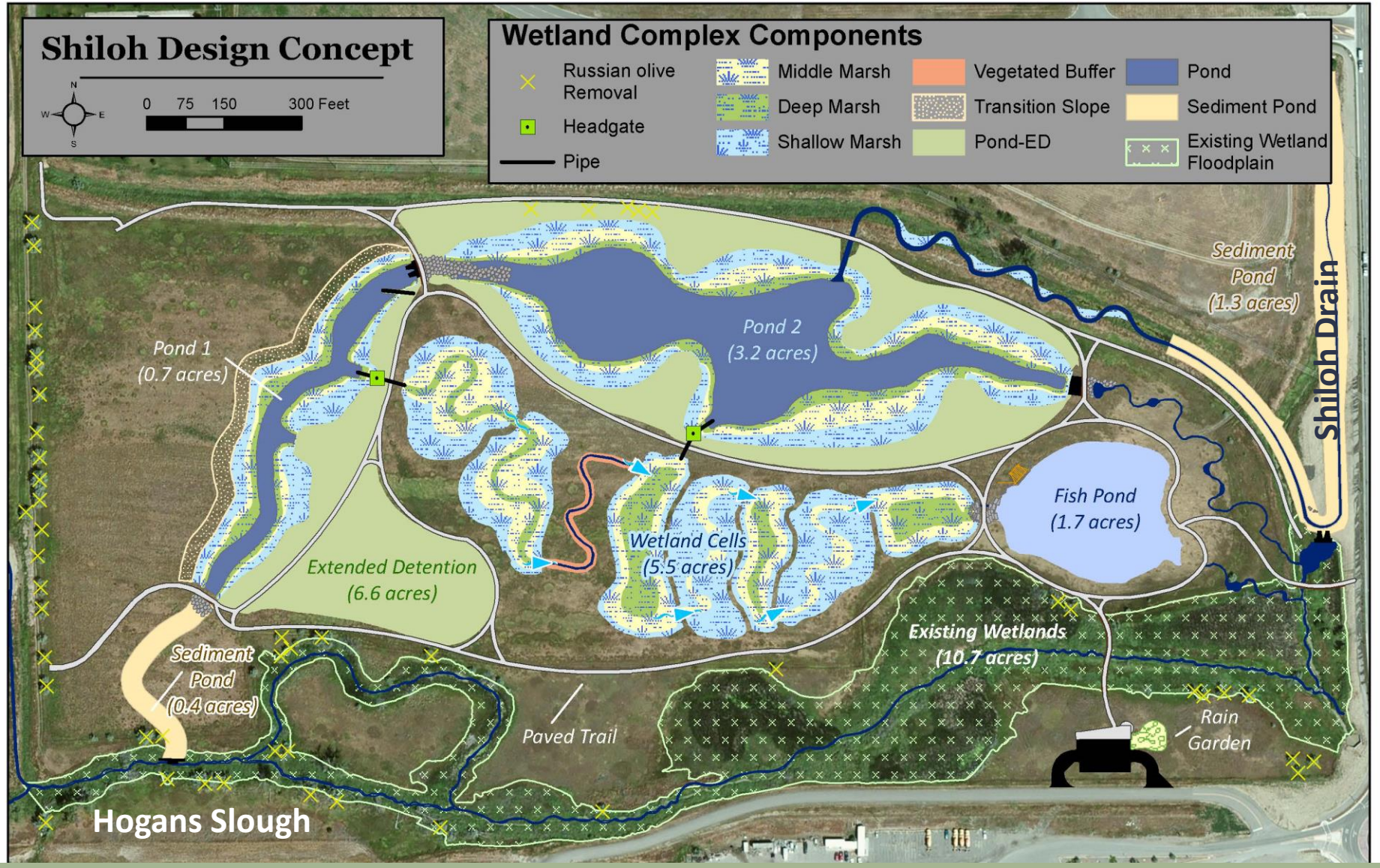
Pond 2 Channel
Low flow with landscape plantings

Shiloh Drain Wetland Channel

Wetland Design

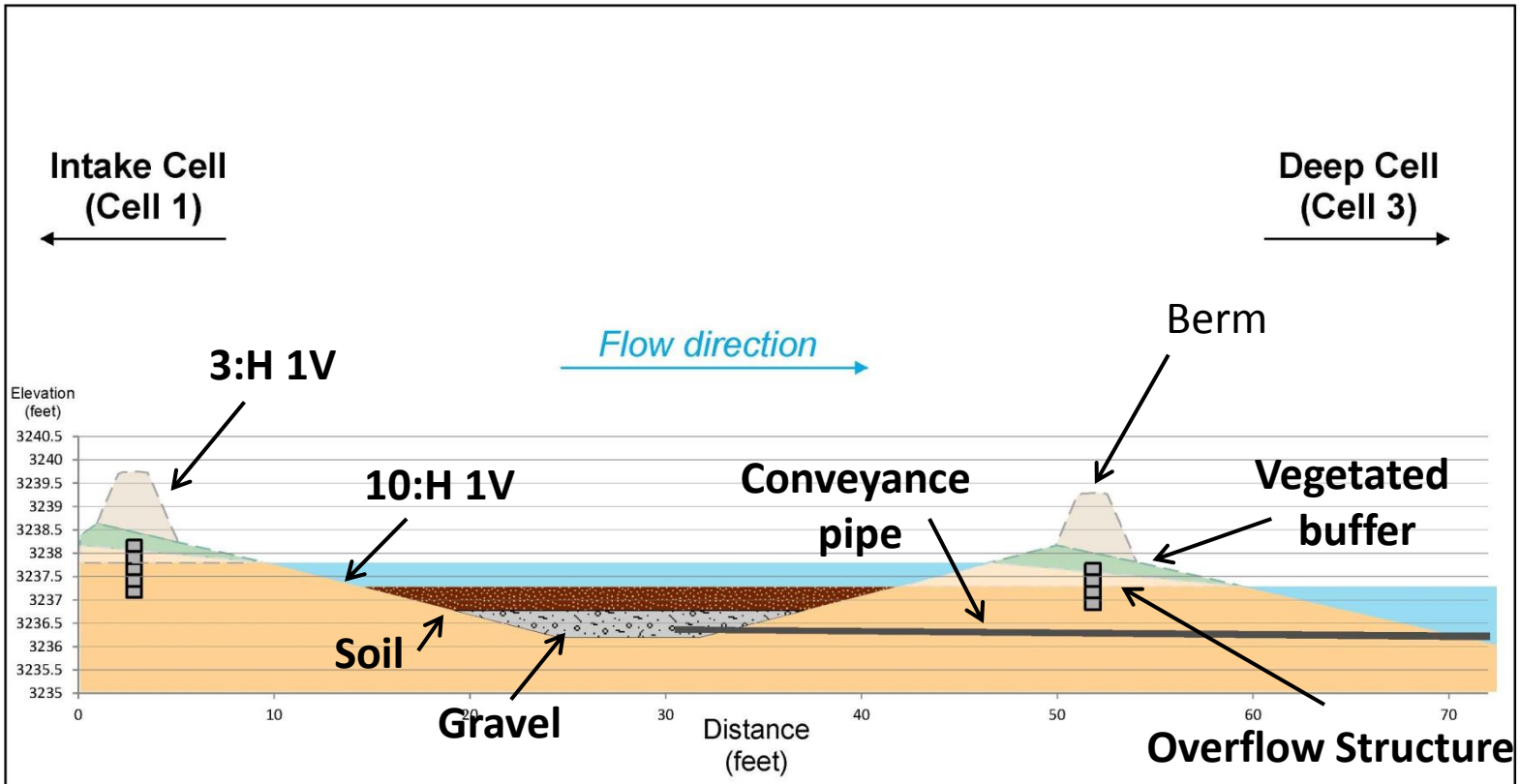


Reference wetland vegetation



- Sediment ponds
- Detention ponds
- Wetland fringe
- Wetland cells
- Diversity

Wetlands – Shallow cell



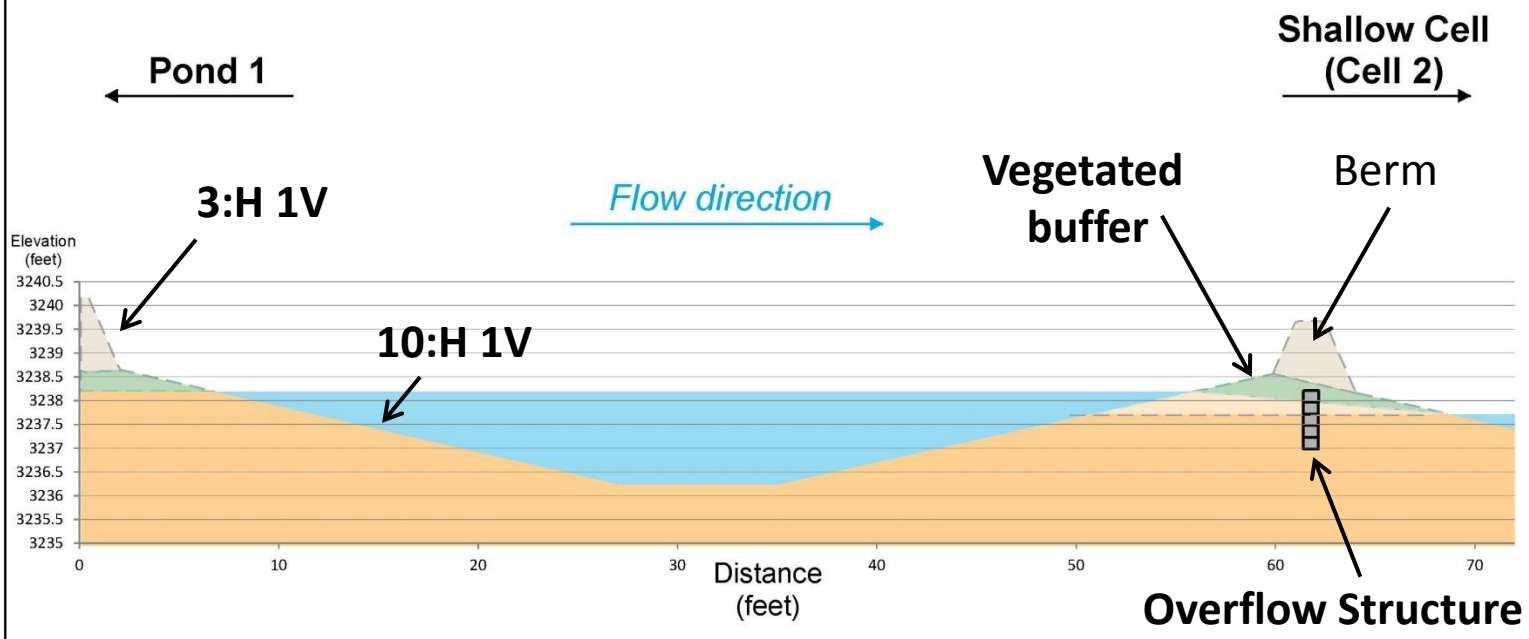
Dashed lines represent areas on either side of water control structures/ flashboards (example - berms, vegetated buffers and some existing ground)

Shallow Cell

Pea gravel over geosynthetic fabric

Soil over pea gravel showing low-flow channel

Wetlands – Deep cell/Intake cell



Dashed lines represent areas on either side of water control structures/ flashboards (example - berms, vegetated buffers and some existing ground)

Wetland Cells

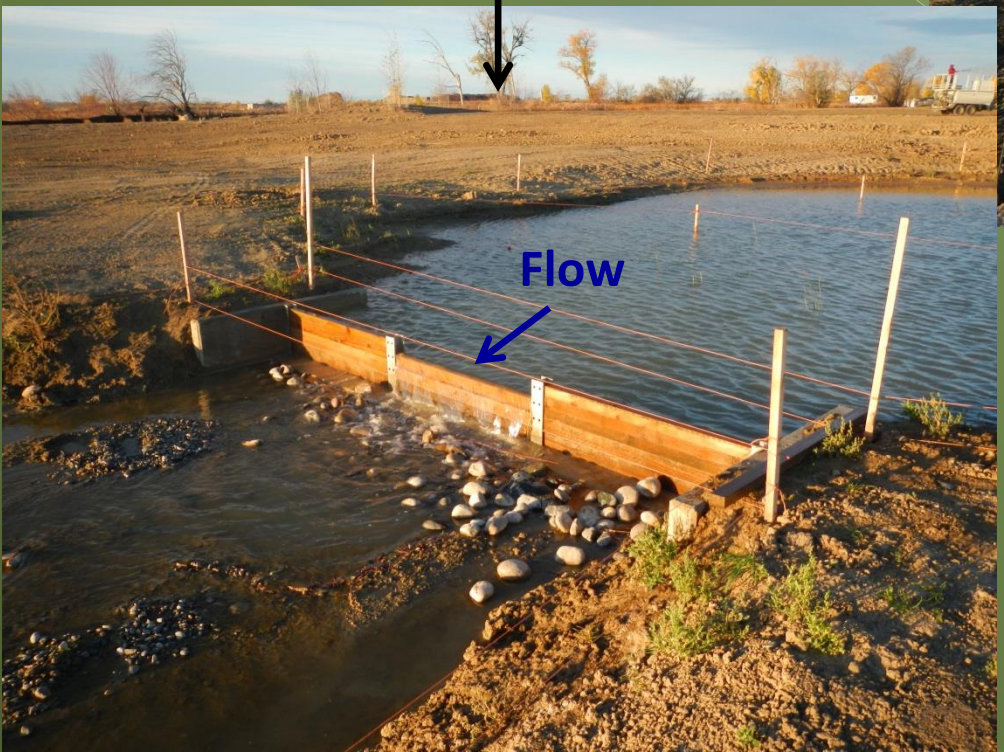
Cell 9 : Shallow Cell

Cell 6 : Deep Cell

Wetland Cell Water Control Structures

Wetland Cells 6 – 10 structures

Wetland Cells 1 & 2 structures



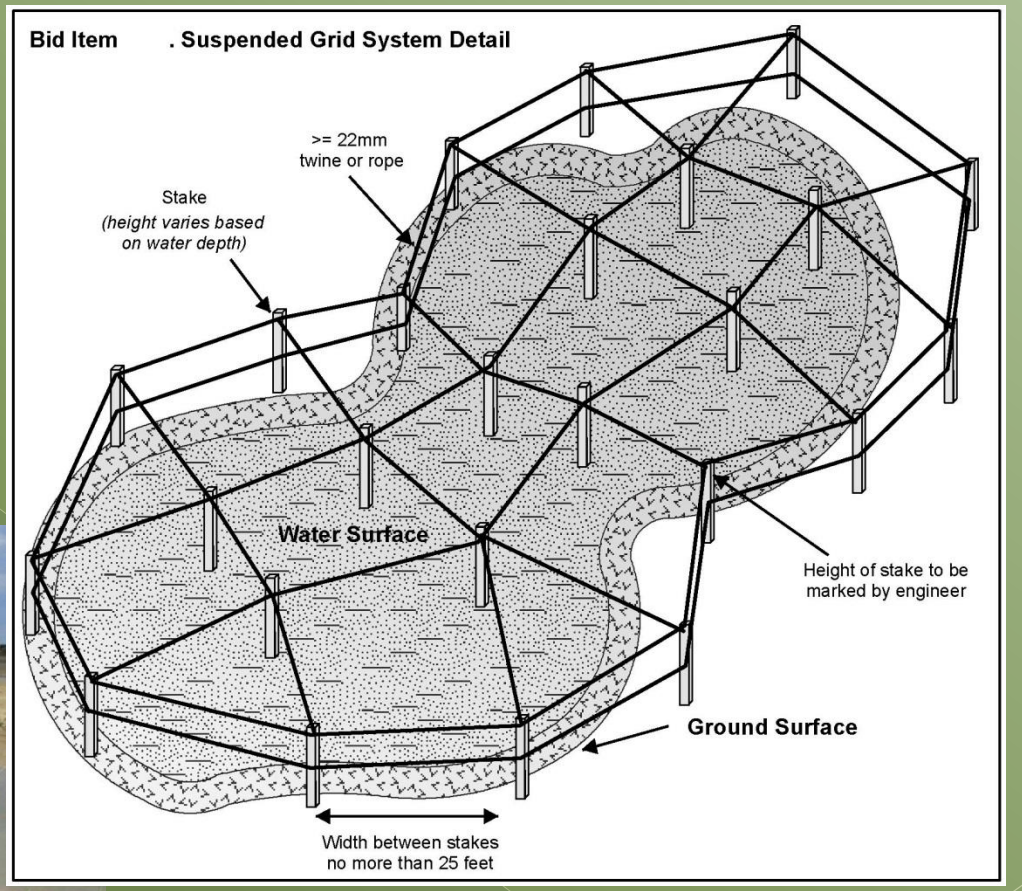
Pond 2

After installation (early July)

Three weeks later

Browse Control—Suspended Grid System

- Ponds – open water
- Cells – closed system

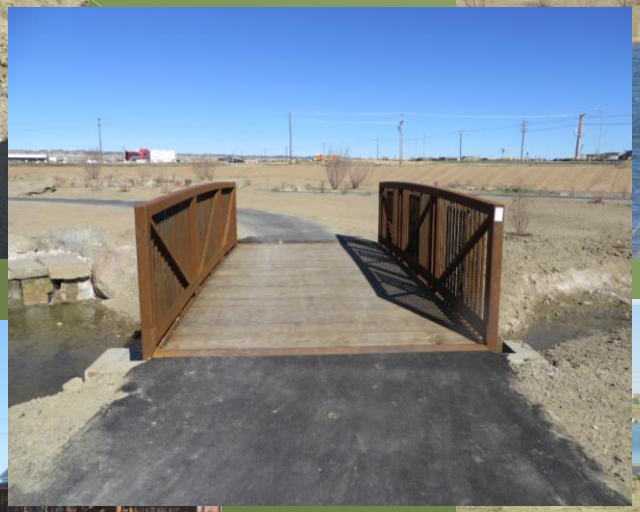


Recreational Opportunities

- Passive Use Recreation
- Urban Fishing
- Primary Shelter

Recreational Opportunities

- 1.85 miles of Trails and Access Paths



Aesthetic Enhancements

Educational Opportunities

- Interpretive Signs
- What is the purpose of the project?
- How does it function?

Educational Opportunities

Contracting

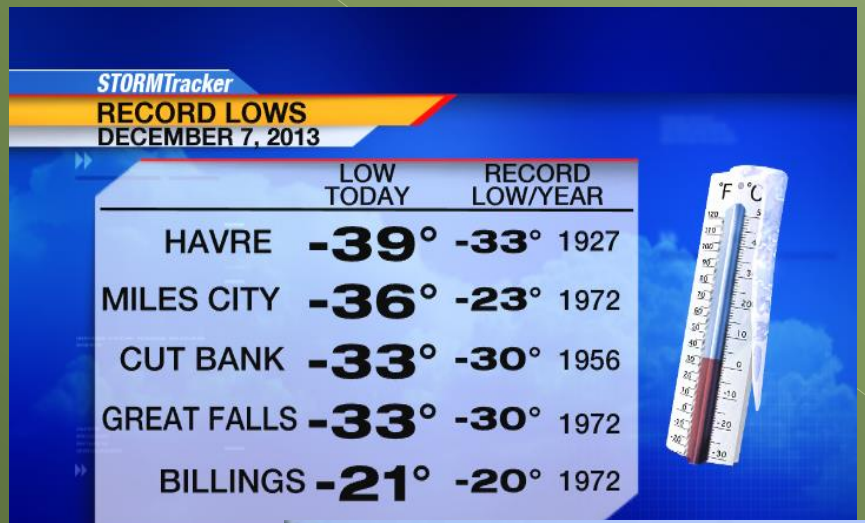
- Construction Cost - $4.25 million
  - Concurrent CTEP Trail Project - $470,000
- Construction began Fall of 2013
- Completed in October 2014

Contracting – Quantities

- 185,000 CY of material to haul – 95,000 CY hauled away
- 1.85 miles of maintenance/pedestrian trails w/ H20 load rated bridges
- 305 trees, 1300 shrubs and perennials
- 24-acres of seeding
- 760 TN of boulders – not including slab and block rock
- 120,000 individual wetland plants – grown a year in advance
- 6,300 SY of GeoWeb and miles of geofabric

Construction Challenges - Weather

- Billings Gazette and KTVQ-2



Construction Challenges - Dewatering

Construction Challenges – Clay/Silty Soils

Construction Challenges – Ditch Flows

Construction Challenges – Structures

The Water Is Flowing

Wetlands & Upland Vegetation is Establishing

Significant Wetland Growth in Shallow Wetland Cells

On Going Growth in Deep Wetland Cells

The Community and Wildlife Loves It

Questions?

Shiloh Conservation Area
City of Billings